AMENDMENTS TO THE CLAIMS

Please amend claims 1, 11, 13 and 14 as follows. The following listing of claims replaces all prior versions and listings of claims in this application:

1. (Currently Amended) A method to determine occupancy of a space by an arbitrarily shaped object, comprising:

providing an optical energy source to generate at least one fan light beam;

defining a reference plane in the space that corresponds to said at least one fan light beam;

disposing a sensor at a known vertical position relative to said reference plane, said sensor having a field of view encompassing at least an intersection of [an] said object within said space with said reference plane;

recognizing solely from a single first image of said space acquired from an output of said sensor any [object] intersection of said reference plane by said object; and

determining occupancy of said space by calculating a shape of any said intersection, a size of any said intersection, and a relative location of [the] any said intersection in said space;

wherein occupancy within said space is determinable using a priori positional relationship between said optical energy source and said sensor without requiring a priori positional knowledge of said object and without requiring a priori shape knowledge of said object.

2. (Previously Presented) The method of claim 1, wherein said optical energy source outputs optical energy selected from a group consisting of visible spectra and invisible spectra.

3. (Previously Presented) The method of claim 1, wherein said reference plane is defined using a rotating light source selected from a group consisting of a laser and a light emitting diode.

4. (Previously Presented) The method of claim 1, wherein said optical energy

source includes a scanning light beam.

5. (Previously Presented) The method of claim 1, wherein said optical energy source includes at least one source selected from a group consisting of a laser and a light emitting diode.

6. (Previously Presented) The method of claim 1, wherein said reference plane is defined using at least one of a laser and a light emitting diode.

7. (Previously Presented) The method of claim 1, wherein said reference plane includes at least one plane selected from a group consisting of ground, a floor of a building, a floor of a room, and a floor of a compartment.

8. (Previously Presented) The method of claim 1, wherein said sensor includes a digital camera.

9. (Previously Presented) The method of claim 1, wherein a vertical distance between said sensor and said reference plane is determined using a size of a smallest object to be detected by said sensor.

10. (Previously Presented) The method of claim 1, wherein recognizing includes:

acquiring a reference training image of an intersection;

acquiring a second image of said space;

processing differences between said training image and said second image, including differences in intersection patterns; and

if an object is recognized as intersecting said reference plane at an intersection, estimating size and location of said object.

11. (Currently Amended) A method to detect presence of at least one arbitrarily shaped object in a region of interest, comprising:

disposing a source of optical energy to emit optical energy towards a potential location of said at least one object within said region of interest;

disposing a single-sensor three-dimensional camera having a field of view substantially coinciding with said region of interest to detect occupancy of an object in said region of interest using optical energy emitted by said source of optical energy and reflected at least in part from said object, said camera disposed in known registration relative to location of said source of optical energy;

detecting with at least one image processing algorithm at least one object nearest said three-dimensional camera using an output of said three-dimensional camera representing a single image of said region of interest; and

calculating with at least one image processing algorithm a volume in front of and behind a nearest object.

12. (Previously Presented) The method of claims 11, wherein said three-dimensional camera includes a stereo-vision camera.

13. (Currently Amended) A system to detect presence of at least one arbitrarily shaped object in a space, comprising:

at least one optical energy source to generate a fan light beam that defines an optical reference plane;

at least one camera disposed at a known vertical position relative to said reference plane and having a field of view encompassing at least a portion of said reference plane; and

an image processing system to process images acquired by said camera to detect [therefrom] solely from any intersection of a viewed said object and said reference plane, and to determine characteristic occupancy in said space from each processed said image and from at least one said intersection characteristic;

wherein occupancy within said space is determinable using a priori positional relationship between said at least one optical energy source and said camera without requiring a priori positional knowledge of said object and without requiring a priori shape knowledge of said object.

14. (Currently Amended) A system to detect an arbitrarily shaped object in a space, comprising:

at least one sensor to acquire [an] a first image of said space, wherein [an] said first image comprises an instance of light recorded on a medium;

means for defining a reference plane using at least one fan light beam; and

means for determining solely from said first image of said space whether the object intersects said reference plane at an intersection; wherein detection of an object in said space is determinable absent a priori positional knowledge of said object in said space and absent a priori shape knowledge of said object.

15. (Previously Presented) The system of claim 14, wherein said means for defining includes at least one of a physical surface and at least one light beam.

16. (Previously Presented) The system of claim 14, wherein said sensor includes a sensor selected from a group consisting of a digital camera and a three-dimensional range sensor.

17. (Currently Amended) The system of claim 14, further comprising means for processing [different] additional images of said space to determine whether said space is empty.

18. (Previously Presented) The system of claim 17, further comprising means for processing [different] said additional images of said space to calculate a full-ness factor when said space is determined to be non-empty.

19. (Previously Presented) The system of claim 14, wherein said system is disposed in an environment selected from a group consisting of a movable robot and a motor vehicle.

20. (Currently Amended) The system of claim 17, further comprising means for processing [different] said additional images of said space to calculate an object in said space when said space is determined to be non-empty.